

**BLACK CHERRY HEALTH ASSESSMENT
ALLEGHENY NATIONAL FOREST - 1995 to 1997**

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Abstract

Natural disturbances to forest ecosystems of the Allegheny National Forest earlier this decade, especially from several annual defoliations by the cherry scallop moth between 1993 and 1995, were considered a threat to the health of black cherry trees. Additionally, several severe droughts (1988, 1991, 1995) were considered to have influenced black cherry health. Field surveys to determine the health of the black cherry resource of the ANF were made annually from 1995 through 1997. The current status and recent trends in black cherry health were based on black cherry crown vigor and dieback as indicators of tree decline and crown mortality. Forest stands under various types of management were sampled where black cherry trees had experienced the highest frequencies of defoliation since 1993. Initially, the assessment included about 600 black cherry trees in five stands on Marienville RD that had either two or three defoliations over several years. In 1996, another 83 black cherry trees on the Bradford RD were added to the assessment in a stand which had multiple natural disturbances (drought, hail damage, cherry scallop shell moth defoliation) in the same year.

Based on black cherry crown vigor at the end of the 1995 growing season, a large majority (85 percent) of the black cherry resource on the Allegheny NF was healthy or showed only light decline despite the recent defoliations and drought. The remainder of the black cherry resource had worse crown vigor (13 percent with moderate and severe decline, 2 percent dead). Furthermore, this health situation remained virtually unchanged after the 1996 growing season even though recurrent defoliation was minimal and precipitation was above normal. The proportion of black cherry trees in the healthiest two crown vigor classes were about the same (84 to 88 percent) at the end of each growing season regardless of whether two or three defoliations had occurred. By contrast, black cherry trees in the stand with concurrent natural disturbances (drought, hail damage, cherry scallop shell moth defoliation) had the lowest proportion (66 percent) in the healthiest crown vigor classes at end of 1996.

Crown dieback at the end of the 1996 growing season indicated that the proportion of black cherry trees with greater than 30 percent dieback, was higher after three defoliations (11 percent) than after two defoliations (7 percent). Trees with mostly dead crowns doubled in occurrence (2 to 4 percent) between the 1995 and 1996 growing seasons. However, nearly all (88 percent) were poletimber or small sawlog sized black cherry trees.

A health assessment of the ANF black cherry resource should be made in 1997 to see if it will improve after another growing season free of cherry scallop shell moth defoliation.

Introduction

Several natural disturbances over the last decade have occurred in forests dominated by black cherry, *Prunus serotina* Ehrh., in the Allegheny Mountains of northwestern Pennsylvania. The black cherry forests in this region form the most valuable timber resource of the Allegheny National Forest (ANF). A health assessment was made by Forest Health Protection (FHP) and ANF Ecosystem Management personnel to provide ANF resource managers with information about the status and trends in the condition of the black cherry poletimber and sawlog trees in stands with the most frequent and severest of these recent disturbances. By making ANF managers aware of any catastrophic decline or mortality occurring in the black cherry timber resource, planning could begin to salvage the most valuable sized trees at risk.

Recent Forest Disturbances on the ANF

The disturbances placing stress on the black cherry trees have been both abiotic (weather) and biotic (insect defoliation). Two types of abiotic stress were important--regional droughts and local storms. Severe droughts occurred in the region during 1988 and 1991; abnormally warm and dry conditions existed in mid-summer of 1995. By contrast, there was an abnormal abundance of rainfall throughout 1996. An intense hail storm in late June 1995 stripped foliage and damaged branches on trees near Cherry Grove, PA, on the Bradford RD. The hail damage was most apparent on open grown trees along forest edges and in certain shelterwood and seed-tree cut stands within this area.

The most important biotic stress factor for black cherry trees involved widespread damage from outbreaks of forest defoliating insects. Moderate or severe defoliation can lead to significant loss of tree growth increment. This normally occurs the year after the leaves are removed because refoliation, when immediately following defoliation in the same season, uses food otherwise stored for the next growing season. Some replenishment of food reserves may occur during the summer of defoliation if soil moisture is adequate and refoliation has time to develop a functioning crown. Soil moisture must also be adequate the growing season after defoliation for a defoliated tree to recover its growth. Growing seasons with ample rainfall favor tree growth, but normally rainfall is least abundant and spotty during the summer. Mid-, to late-summer defoliations, such as those caused by the cherry scallop shell moth, do not allow the recovery of full crowns before leaves cease functioning with the onset of shorter daylight in autumn. Dieback, a more permanent type of damage compared to defoliation, often occurs as defoliated trees fail to fully recover a completely functioning crown. Black cherry trees with greater than 30 percent dieback were considered to be at greatest risk for additional health problems. Dieback on the main stem of a tree can reduce height growth, and may ultimately influence tree form. General tree decline can lead to a condition where secondary beetles, such as the peach bark beetle, *Phloeotribus liminaris* (Harris), may attack and kill black cherry trees.

Several species of lepidopterous (moth) larvae contributed to the recent outbreaks in black cherry forests on the ANF. The forest tent caterpillar, *Malacosoma disstria* Hubner, and elm spanworm, *Ennomos subsignaria* (Hubner), at least partially defoliated black cherry trees at scattered locations on the ANF in 1993 and 1994. The most persistent stress to black cherry trees, however, has come from the outbreaks of the cherry scallop shell moth (CSSM), *Hydria prunivorata*

(Ferguson). From 1993 through 1995, black cherry trees were completely defoliated by CSSM over an ever-increasing area until its outbreak collapsed in 1996 (refer to Map). The CSSM is a native insect causing significant defoliation in the middle of the summer (late July and August). CSSM infestations have occurred in the ANF approximately every 10 years over the last 30 years. The most recent outbreak, however, was particularly severe. Defoliation began in 1993 on 3,840 acres, increased to 54,200 acres in 1994, peaked at 205,400 acres in 1995, and dropped to 9,835 acres in 1996. The worst year of defoliation coincided during July and August 1995 with about a month of dry, warm weather. Refoliation during late summer of 1995 was less than in the spring of 1995, and large portions of the crown in some trees remained without leaves until the spring of 1996. Cherry scallop shell moth defoliation in 1996 tended to be localized in areas not previously affected.

Methods

Black Cherry Health Assessment Sample Design

Assessments of black cherry health were based on field sampling after the growing seasons of 1995 and 1996. Each sample documented the crown vigor and dieback of individual black cherry trees (refer to Crown Rating Criteria discussed in detail later in this section). Additionally, the DBH (diameter at breast height) of each tree greater than five inches DBH was measured with a diameter tape to the nearest 0.1-inch to express black cherry health by the four timber merchantability size classes used by the Allegheny NF. These classes were: poletimber (5.0-10.9 inches DBH); small sawlogs (11.0-14.9 inches DBH); medium sawlogs (15.0-18.9 inches DBH); large sawlogs (19.0+inches DBH). Early in the 1996 growing season tree crown vigor was evaluated to determine if catastrophic changes in black cherry health had occurred following the multiple stresses affecting black cherry in 1995.

In all, 689 black cherry trees were selected for sampling using 15 or 16, 10 BAF prism plots in each of six stands. Appendix A provides details for relocating the stands and plots within each to permit future observations of each sample tree used in this assessment. Five stands were located on the Marienville RD in the autumn of 1995; one stand on the Bradford RD was added in the spring of 1996. The Salmon Creek and Slater Run stands had received two years of recent CSSM defoliation, whereas the Beaver Meadows, Buzzard Swamp and Raven Run stands had been defoliated for two years during the recent CSSM infestations. The Vandergriff Corners stand on the Bradford RD represented a stand of predominantly large sawlog-sized black cherry trees with lower than normal basal area that received two defoliations in 1995, first from a spring hail storm, and later from a summer CSSM outbreak.

Black Cherry Tree Crown Vigor and Dieback Ratings

Black cherry tree health was assessed by FHP and ANF personnel certified through North American Maple Project (NAMP) training. The training provided the experience to understand and apply accurately and consistently the visual tree crown rating criteria presented below.

The following criteria and definitions were based on North American Maple Project (NAMP) protocols and were used in this assessment for visually rating the crowns of individual black cherry trees.

A. Tree Crown Vigor Rating Criteria

The acceptable error was plus-or-minus one vigor class. Vigor ratings were done before rating crown dieback. The percentages of damage used for defining vigor rating classes were independent estimates, not related to the sums of crown rating percentages. The following codes were used:

1-healthy; tree appeared to be in reasonably good health; no major branch mortality; crown was reasonably normal within the stand situation; less than 10 percent branch or twig mortality, foliage or discoloration present.

2-light decline; branch mortality, twig dieback, or foliage discoloration was present in 10 to 25 percent of the crown; broken branches or crown area missing based on presence of old snags was less than 26 percent.

3-moderate decline; branch mortality, twig dieback, or foliage discoloration was present in 26 to 50 percent of the crown; broken branches, or crown area missing based on presence of old snags was 50 percent or less.

4-severe decline; branch mortality, twig dieback, or foliage discoloration present in more than 50 percent of the crown, but foliage was still present to indicate the tree was alive; broken branches, or crown area missing based on presence of old snags was more than 50 percent; branch breakage and crown area missing was recorded in the 10-percent classes in the notes.

5-dead, natural; tree is standing dead; phloem under bark had brown streaks; few epicormic shoots were present on the bole; no further entries needed.

6-dead, tree removed, or dropped; tree had been sawed or girdled by humans

B. Crown Dieback Rating Criteria

The rating system consisted of a 10-percent class rating system, except that the first class of 0 to 5 percent was subdivided into two classes. The "0" class was reserved for absolute zero, while the 5-percent class included trace to 5 percent. This system was used to assess crown dieback in sample black cherry trees. Crown dieback was branch mortality that began at the terminal portion of a limb and progressed downward. Essentially, crown dieback was an estimate of the proportion of the crown silhouette containing branches without leaves.

Snag branches are not part of the crown and were not included in the dieback percentage. Snag branches are those large branches without small twigs under 2.5 cm (1 inch) diameter that usually do not have the bark peeling away or have only dead bark. Such branches are assumed to have died many years before the present assessment began. Likewise, branch mortality at the base of the crown, assumed to be the result of shading, was not included in the dieback rating.

Results

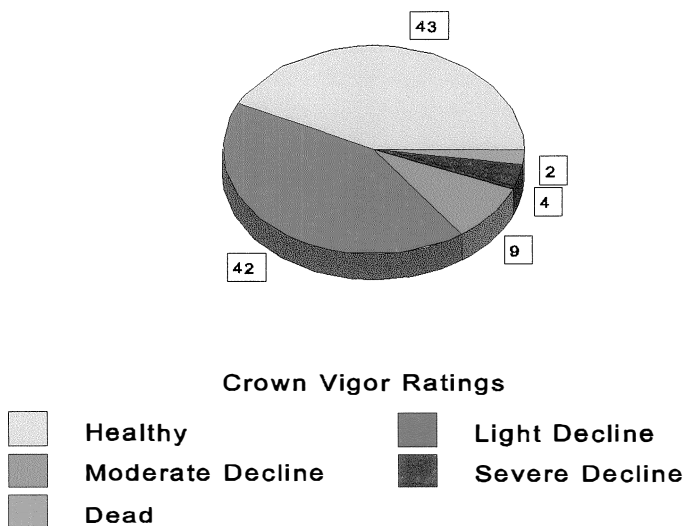
The interpretation of current black cherry health for the Allegheny NF was based largely on a summary of the crown vigor and dieback ratings obtained from all the black cherry trees in the five stands surveyed on Marienville RD at the end of the 1996 growing season (refer to Appendix B, Table 9). The same information on an individual stand basis is presented in Appendix B, Tables 1 through 5. The other tables in Appendix B have data for the single stand on the Bradford RD (Table 6) or have summarized the Marienville RD data for sites with either two (Table 7) or three (Table 8) CSSM defoliations.

For those seeking more specific data about the number and percent of black cherry trees with each type and class of crown rating (refer to Appendix B, Tables 1A&B through 9A&B). The data concerning black cherry tree crown vigor is shown separately (A part of each Table) from crown dieback (B part of each Table). All data for both tree crown vigor and crown dieback have been presented by four timber merchantability classes. The tabulations also give a more detailed presentation of results of the black cherry health assessment for the Allegheny NF after each growing season (Fall 1995 and Fall 1996), as well as, earlier in 1996 (Spring 1996).

The following several pages summarize key points about black cherry health on the Allegheny NF.

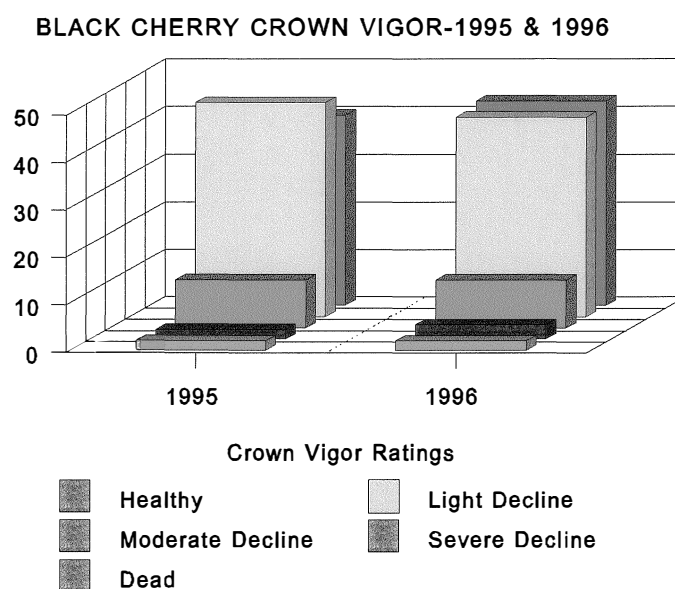
1996 Black Cherry Crown Vigor. The 1996 black cherry crown vigor ratings crown vigor ratings of all the black cherry trees sampled (606) indicated that overall 43 percent of the trees were healthy, 42 percent had light decline, and 15 percent had moderate or greater decline. The proportion of the black cherry trees classed as healthy varied among stands surveyed, but there was a pattern for fewer healthy trees in stands with more frequent defoliations.

Black Cherry Crown Vigor-1996



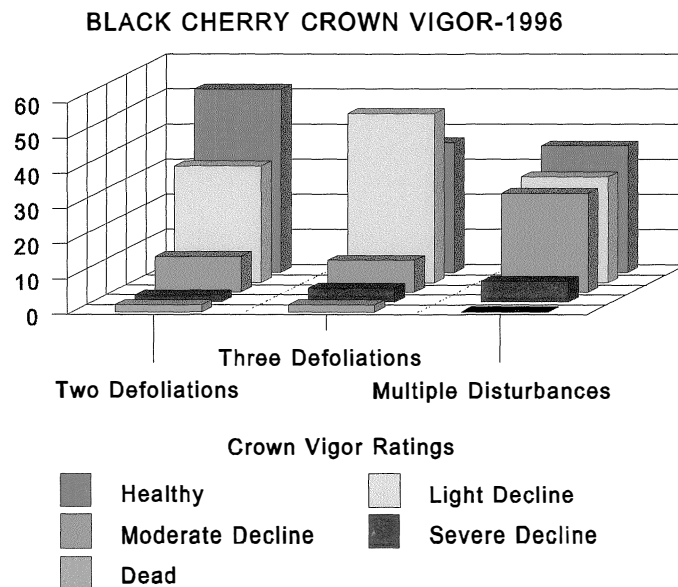
Black Cherry Crown Vigor Trend. A comparison of results obtained after the 1995 with those after 1996 growing seasons can give the short-term trend in black cherry health. This trend information is shown on each Appendix Table under the column heading "Post-Growing Season Survey Year". Based on crown vigor ratings of all the black cherry trees sampled (606) each year, a large majority (85 percent) of the black cherry resource on the Allegheny NF was determined to be

healthy or showed only light decline after the 1995 growing season despite the recent defoliations and drought. The remainder of the black cherry resource had worse crown vigor (13 percent with moderate and severe decline, 2 percent dead). Furthermore, this health situation remained virtually unchanged after the 1996 growing season even though recurrent cherry scallop shell moth defoliation was minimal and rainfall above normal.



Black Cherry Crown Vigor and Frequency of Natural Disturbances. The influence of frequent natural disturbances on black cherry health can be examined with those stands on Marienville RD and their two or three defoliations in comparison with the stand on Bradford RD and its multiple disturbances in the same year. The proportion of black cherry trees in the two healthiest crown vigor classes at the end of the 1996 growing season was the same (85 percent) for black cherry trees

sampled (244) with two defoliations compared with those sampled (362) with three defoliations. However, the healthy trees dropped from 52 percent in stands defoliated for 2 years to 37 percent in stands defoliated for 3 years. Furthermore, trees in stands defoliated twice maintained the same advantage over those defoliated three times after the 1996 growing season by recruitment from the light decline vigor class. However, in all these black cherry stands, the percent of trees with moderate or greater decline was nearly the same regardless of defoliation frequency. By contrast, the black cherry trees sampled (83) in a stand with multiple natural disturbances (drought, hail damage, cherry scallop shell moth defoliation) had the lowest proportion (66 percent) in the healthiest crown vigor classes at end of 1996. Nearly one-third (28 percent) of the black cherry trees in this type of stand occurred in the moderate decline class.



Black Cherry Crown Dieback Frequency and Trend. Results based on crown dieback at the end of the 1996 growing season indicated that a minority of the black cherry resource of the Allegheny NF had experienced this more permanent type of damage. The proportion of black cherry trees in 1996 with greater than 30 percent dieback was higher after three defoliations (11 percent) than after two defoliations (7 percent), although this type of damage affected few trees overall. Trees with

mostly dead crowns, although not frequently see during the survey, doubled in occurrence (2 to 4 percent) between the 1995 and 1996 growing seasons. However, nearly all (88 percent) were poletimber or small sawlog-sized black cherry trees.

Recommendations

Recommendations are to continue the assessment, at least through the 1997, to determine if the health of the ANF black cherry resource will exhibit a major improvement after another growing season free of defoliation.

APPENDIX A

BLACK CHERRY HEALTH ASSESSMENT ALLEGHENY NATIONAL FOREST

SURVEY STAND AND PLOT LOCATIONS

MARIENVILLE AND BRADFORD RDs

APPENDIX B

BLACK CHERRY HEALTH ASSESSMENT

ALLEGHENY NATIONAL FOREST

BLACK CHERRY

CROWN VIGOR AND DIEBACK STAND SUMMARIES

TABLES

1A&B - 9A&B